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WITNESS my hand this
Tenth day of December 2003

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AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

Applicant(s):

TEC-TRUSS Holdings Pty Ltd

Invention Title:

COMPOSITE BEAMS

The invention is described in the following statement:

COMPOSITE BEAMS

Field of the Invention

The present invention relates to composite steel-and-timber beams and to steel connectors used in such beams. The beams may be used as bearers, joists, lintels and alike and may be used to support flooring and roofing in long spans in both domestic and commercial buildings.

Background of the Invention

Environmental concerns over recent decades has resulted in timber supplied from forest plantations to be favoured over timber harvested from native forests. One of the disadvantages in using timber from forest plantations is that larger timber sections previously harvested from native forests are not available. This has therefore, in part, resulted in the development of composite beams in which a number of small section timber members are assembled together to form a large beam.

A detailed description of composite steel-and-timber structural beams is provided in our earlier International patent application PCT/AU95/00494 (WO9605385), the entire contents of which is hereby incorporated into this specification. In summary the International application describes several embodiments of an I-beam having upper and lower flanges, wherein each flange is formed from a pair of members, usually timber members, arranged on opposite sides of a continuous steel web connector that interconnects the flanges. The continuous steel web connector also includes a series of stiffened panels separated by holes through which sewer pipes, water pipes, electrical cables, air conditioning ducting, strong backs, load spreaders and cantilever members can be laid. Each beam is currently fabricated by positioning the timber

members either side of an upper or lower edge of the steel web connector and driving long nails completely through one of the timber members, through the steel web interposition between the timber members and into to the timber member on the other side.

As fabricating beams in this manner can be both time consuming and labour intensive, there is a need for an improved connector suitable for fixing timber members thereto that can function as the flanges of an I-beam.

Summary of the Invention

According to the present invention there is provided a metal connector for use in the fabrication of structural I-beams having upper and lower flanges, each flange formed from a pair of timber members arranged one each side of the connector, the connector having two spatially separated attachment sections suitable for being positioned between the pairs of members, wherein at least one of the attachment sections has a plurality of spikes projecting outwardly from each side that are capable of piercing and fastening a pair of timber members to the connector to form one of the flanges of the beam.

An advantage provided by the invention is that a pair of timber members can be attached to the connector without the need to manually nail the timber together as carried out previously.

It is preferred that each of the attachment sections have spikes projecting outwardly for piercing and fastening pairs of timber members thereto. According to this preferred aspect of the invention, two pairs of timber members, each forming either the upper or lower flange of an I-beam, can be fitted to the connector by spikes projecting outwardly therefrom.

Although the spikes may have a variety of possible configurations, including double ended nails passing through and fixed in position to the attachment sections, it is preferred that the spikes be formed from tabs made in the or each attachment section and interconnected thereto by interconnecting portions, the interconnecting portions capable of being bent so that the tabs form said spikes. In other words, according to one preferred embodiment, the spikes may be integral with the attachment sections and thus formed from the same material as the attachment sections.

As will be explained below in further detail, the timber members can be attached to the connector by two different methods. One method involves simultaneously pressing pairs of timber members onto spikes on opposite sides of the attachment sections. A difficulty that may be encountered while attaching the timber members in this manner is that the attachment section can be deformed as a result of the forces acting in one direction in localized regions while attaching the timber members. In order to prevent deformation of the attachment section during attachment of the timber members to the spikes, it is preferred that the interconnecting portion of most spikes projecting outwardly from one side of the attachment section be located adjacent to the interconnecting portion of spikes that project outwardly from the other side of the attachment section. In other words, according to this preferred aspect of the invention, spikes projecting from opposite sides of the attachment section are located such that forces in opposite directions are applied to the attachment section in localized regions while attaching the timber members.

It is preferred that spikes projecting from opposite sides of the attachment section and having adjacent interconnecting portions be separated by a space ranging

from 3 to 15mm. It even more preferred that the spacing range from 4 to 8mm.

It is even more preferred that adjacent interconnecting portions be separated by spaces that are equal to or less than the length of the spikes projecting from the attachment section.

It is preferred that the spikes be arranged in rows and ranks on the attachment section, and that adjacent interconnecting portions of the spikes projecting from opposite sides of the attachment section be in different ranks. It is even more preferred that the ranks be arranged diagonally across the attachment section such that the interconnecting portions of the spikes in one rank be located adjacent to the interconnecting portion of the spikes in another rank.

It is preferred that the rows or ranks be defined by a plurality of pairs of spikes projecting outwardly from one side of the attachment section. It is even more preferred that an adjacent rank have spikes projecting outwardly from opposite sides of the attachment sections.

It is preferred that the spikes projecting from each side of the attachment section have at least two different lengths. Although the shear strength of the interconnection between two timber members provided by the connector is partly independent of the length of the spikes, the degree to which the connector resists separation from the timber members largely depend on the length of the spikes. Specifically, the longer the spikes the greater the force required to separate the timber from the connector.

It is even more preferred that the length of the spikes range from 3 to 15mm. It is still even further preferred

that the length of the spikes range from 5 to 9mm.

It is preferred that the spikes have means for preventing timber once attached to the spikes from becoming separated or detached from the spikes. It is even more preferred that means for preventing the timber from separating from the spikes include the spikes being twisted about an axis lateral to the attachment section and curved when viewed in section across the axis.

According to the present invention there is also provided an I-beam including a connector characterized by any of the features described above and two pairs of timber members forming the upper and lower flanges.

According to the present invention there is also provided a method of making an I-beam having a connector characterized by any of the features described above, the method including the steps of:

a) positioning the connector into a pressing station;

b) positioning a pair of timber members either side of at least one attachment section having spikes projecting therefrom; and

c) simultaneously pressing the timber members onto the spikes so as to form a flange of an I-beam.

In the instance when the connector has spikes projecting from both attachment sections, it is possible that a further pair of timber members may be fixed to the connector in the pressing station or an additional pressing station may be used to attach a second pair of timber members. Moreover, any suitable means, such as nailing, can be used to attach a second pair of timber members.

According to the present invention there is also provided

a method of making an I-beam having a connector characterized by any of the features described above, the method including the steps of:

a) positioning the connector in a pressing station having a female template that receives the spikes on one side of the connector;

b) positioning and pressing a timber member onto the spikes projecting from the other side of the connector;

c) releasing the spikes from the female template; and

d) positioning and pressing a further timber member onto the spikes previously received by the female template so as to form a flange of an I-beam.

Brief Description of the Drawings

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings, in which:

Figure 1 illustrates a front view of a connector having spikes;

Figure 2a is a cross-sectional view of the connector shown in Figure 1;

Figure 2b is a cross-sectional view of an I-beam including the connector shown in Figures 1 and 2a;

Figure 3 is a cross-sectional view of an alternative embodiment of a connector;

Figure 5A illustrates a front view of an attachment section of a connector according to one embodiment;

Figure 5B illustrates a side view of the attachment section of the connector shown in Figure 5A;

Figure 5C illustrates a cross-section view along the line A - A in Figure 5A; and

Figures 6A to 9C illustrate 4 alternative embodiments, each represented by a front view, a side view, and a cross-sectional view as in Figures 5A to 5C.

Figure 4 is a cross-sectional view of a connector only having spikes on one side of the connector and has been included for illustration purposes only.

Detailed Description of Preferred Embodiment

The same reference numerals have been used to identify similar and substantially identical features of the various embodiments throughout the Figures.

As can be seen in Figure 1, the connector includes upper and lower attachment sections 10a and 10b each having spikes 13 to which timber members can be attached to form flanges of an I-beam. Although not shown in the Figures, each flange is formed from a pair of timber members arranged one each side of the attachment sections 10.

The connector may also include any additional features and may, as is illustrated in Figure 1, include some of the features of the steel webs described in International application WO9605385. Specifically, the continuous connector includes stiffened panels 11 defined by vertical ribs pressing into the connector that interconnect the upper and lower attachment sections. The stiffened panels 11 are separated by holes 12 through which utility conduits for sewerage, mains water, gas, air conditioning ducting, strong backs, load spreaders and cantilever members can be laid.

The connector shown in Figure 1 may be supplied in long

flat lengths or in a coiled form. Similarly, the connector may be supplied in short lengths, wherein many connectors may be spaced apart with gaps therebetween along the length of the I-beam. Irrespective of the form in which the connector is supplied, the connector is ideally made from galvanized steel ranging from, but not limited to, 0.8 to 2.0mm in thickness.

Figure 2a is a cross-sectional view of the connector shown in Figure 1 and has spikes 13 that projected from both sides of the top and bottom attachment sections 10.

Figure 2b illustrates an I-beam having pairs of timber members 17 fitted to the spikes shown in Figure 2a.

Figure 3 illustrates an alternative embodiment in which the spikes 13 project outwardly from both sides of the upper attachment section 10a for attaching a pair of timber members. A second pair of timber members may then be attached to the lower attachment section 10b using prior art techniques.

Figures 5A to 9C illustrate in greater detail the attachment sections 10 of a series of alternative embodiments having spikes 13 projecting from opposite sides.

Each embodiment shown in Figures 5A to 9C includes spikes 13 that are formed by cutting pairs of tabs 14 into the attachment sections 10 using any suitable cutting device. Each pair of tabs 14 is indicated in Figures 5A, 6A, 7A, 8A and 9A by an elongated shape with rounded ends that has either been shaded-in or left unshaded in which the tabs are indicated by an outline only. Each pair of tabs 14 is formed such that a free end 15 of each tab abuts against the free end 15 of the other tab with which it forms a pair. The free end 15 of each tab is illustrated in

Figure 5A by a diagonal line in the unshaded pairs of tabs. At the opposite end to the free end 15, each tab is integrally fixed to the attachment section 10 by an interconnecting portion 16. As can be seen in Figures 5B and 5C, the interconnecting portions are bent so that the tabs project outwardly from the attachment section to form the spikes 13.

In particular, the tabs illustrated as an outline in Figures 5A to 9A are bent forwardly which in cross-sectional view project upwardly. The shaded tabs of Figure 5A to 9A are bent backwardly which in cross-sectional view project downwardly.

The diagonal line denoting the free end of the tabs 14 also defines a tapering tip portion of the spikes 13 when the tabs 14 are bent outwardly.

The interconnecting portions of the spikes 13 projecting forward are sufficiently adjacent to the interconnecting portion 16 of the spikes 13 projecting backward such that forces in opposite directions are applied to the attachment section 10 via the spikes in localized regions, thereby preventing the attachment section 10 from becoming permanently bent while the timber members are fitted to the attachment section. Typically, the spacing between adjacent interconnecting portions 16 of spikes 13 projecting from opposite sides ranges from 3 to 15 mm or even more preferably from 4 to 8mm.

With particular reference to Figures 5A to 5C, the attachment section has a single row of spikes 13 projecting outwardly from both sides. The spacing between each pair of spikes, projecting from opposites, defines the spacing between adjacent interconnecting portion 16.

Figures 6A to 6C illustrate an alternative embodiment of

an attachment section having two rows of spikes 13 and a series of diagonal ranks. As with all of the embodiments illustrated, the spikes are formed in pairs and the spikes of each pair are bent outwardly in the same direction from the attachment section. However, unlike the embodiment shown in Figures 5A to 5C, the spikes 13 are provided in two different lengths.

In addition, the ranks are arranged into groups of two that are positioned closer together than to a rank of an adjacent group of two. Therefore, as can be seen in Figures 6B and 6C, the spacing between adjacent interconnecting portions of longer spikes that projecting from opposite sides of the attachment section is less than the spacing between short spikes that project from opposite sides of the attachment section. This is feasible on account that the total force required to attach the shorter spikes is less than the total force required to attach the longer spikes to the timber.

Figures 7A to 7C illustrate an alternative embodiment also having long and short spikes 13. However, in this instance the top row of spikes 13 are pushed backwardly whereas the bottom row of spikes are pushed forwardly. As a result, adjacent interconnecting portions 16 of spikes 13 that project from opposite sides are located in different rows.

The embodiment illustrated in Figures 9A to 9C is substantially the same as the embodiment shown in Figures 7A to 7C, save for the inclusion of 4 rather than 2 rows of spikes 13.

Figures 8A to 8C illustrate another embodiment in which the spikes 13 are substantially the same length. The spikes 13 are arranged in three rows and a series of ranks that are offset and either have spikes 13 that project

backward or forward.

As mentioned above, Figure 2b illustrates an I-beam having pairs of timber members attached to the upper and lower attachment section 10a and 10b. The timber members may be attached using at least two methods, both of which are now described.

One method involves simultaneously attaching a pair of timber members onto spikes 13 on opposite sides of the attachment sections 10. This method is characterized by: positioning the connector into a pressing station; positioning the pair of timber members on either side of the attachment sections 10 of the connector having spikes 13 projecting therefrom; and simultaneously pressing the timber members onto the spikes 13 so as to form a flange of an I-beam.

This method may also be characterized by two or more pairs of timber members being fixed to the connector in the same pressing station or in a further pressing station. However, in the instance when only one of the upper or lower attachment section 10a or 10b has spikes, a pair of timber members may be attached to the attachment section 10 not having spikes using known prior art techniques.

Another method involves attaching a pair of timber members into the attachment section 10 of a connector in a multistage procedure in which one member is pressed onto one side of the attachment section 10 followed by a second member being pressed onto the other side of the attachment section 10.

This method is characterized by: positioning the connector in a pressing station having a female template that receives the spikes on one side of the connector; positioning and pressing a timber member onto the spikes

projecting from the other side of the connector; releasing the spikes from the female template; and positioning and pressing a further timber member onto the spikes connector so as to form a flange of an I-beam.

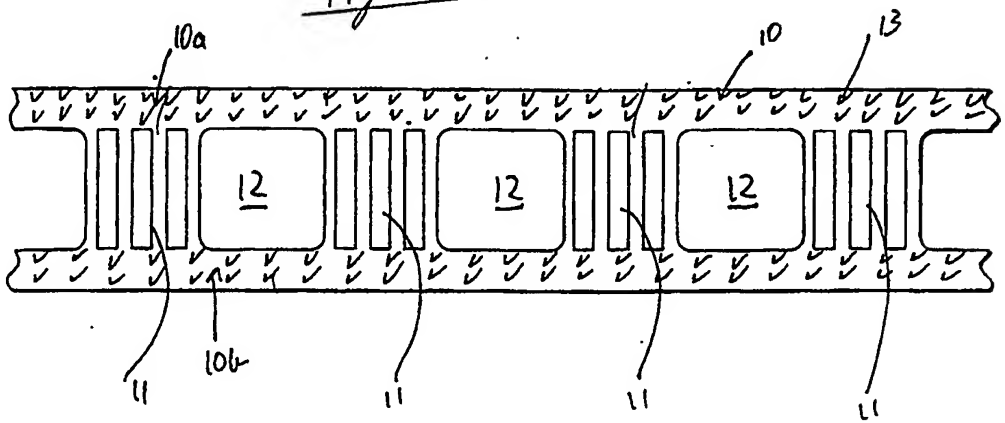
It would be understood by those skilled in the art of the present invention that modifications may be made without departing from the spirit and scope of the present invention.

For example, the spikes may be provided in a suitable form including double ended nails passing through and fixed in position to the attachment sections.

Figure 4 illustrates an alternative arrangement which, although not particularly relevant to the present invention may be of some interest. Specifically, this arrangement includes spikes 13 that project from only one side on both the upper and lower attachment sections 10 of the connector.

Dated this 22nd day of November 2002
TEC-TRUSS Holdings Pty Ltd
By their Patent Attorneys
GRIFFITH HACK
Fellows Institute of Patent and
Trade Mark Attorneys of Australia

Figure 1



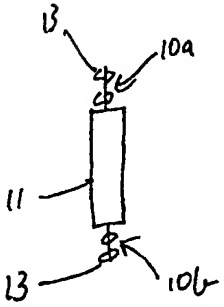


Figure 2a

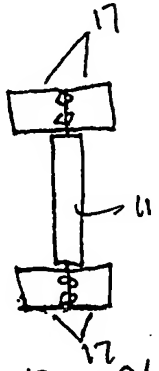


Figure 2b

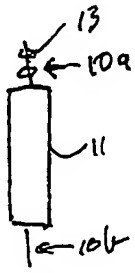


Figure 3

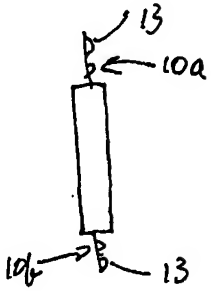


Figure 4

Figure 5A

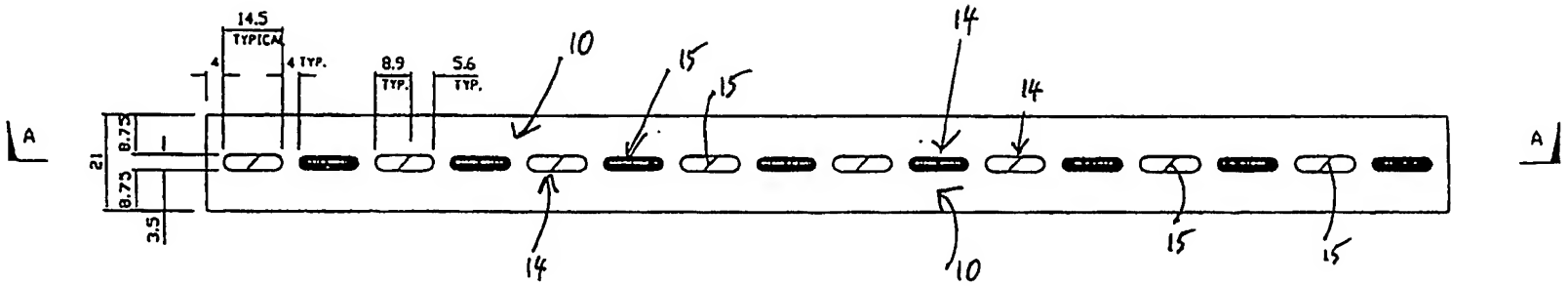


Figure 5B

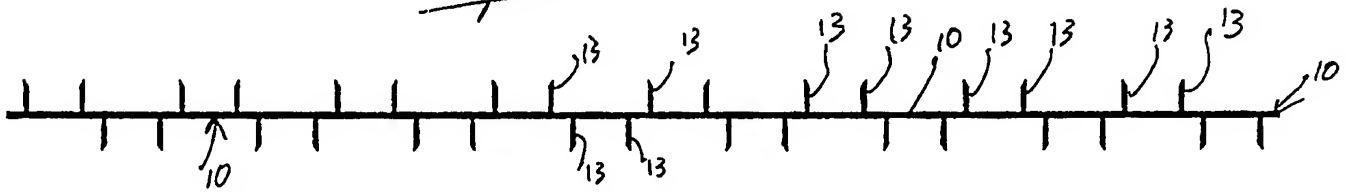


Figure 5C

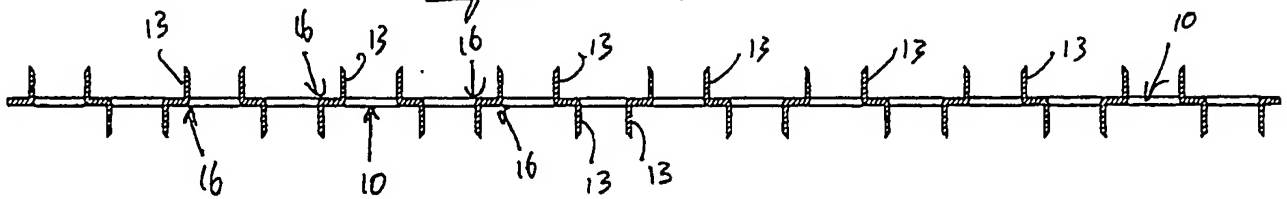


Figure 6A

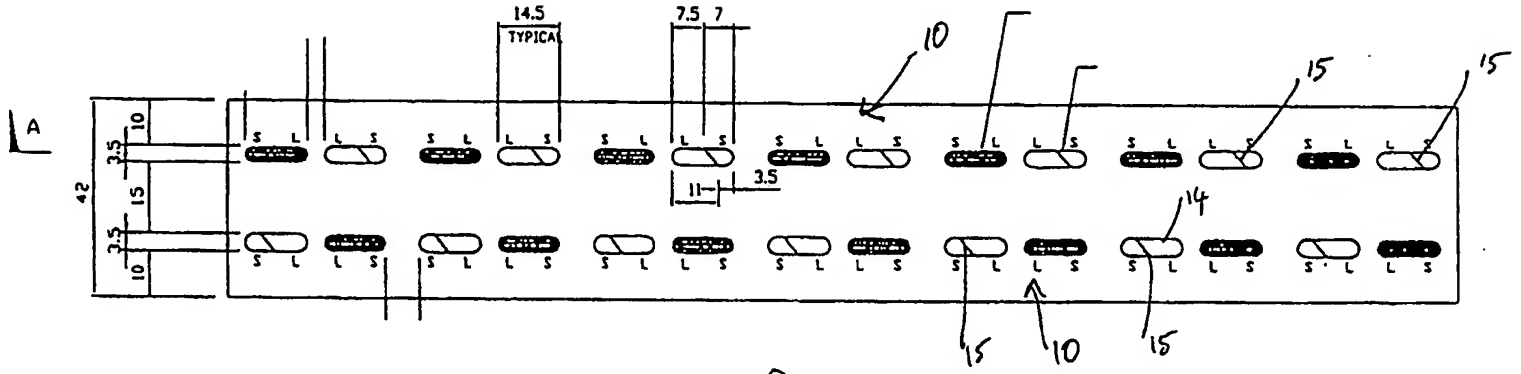


Figure 6B

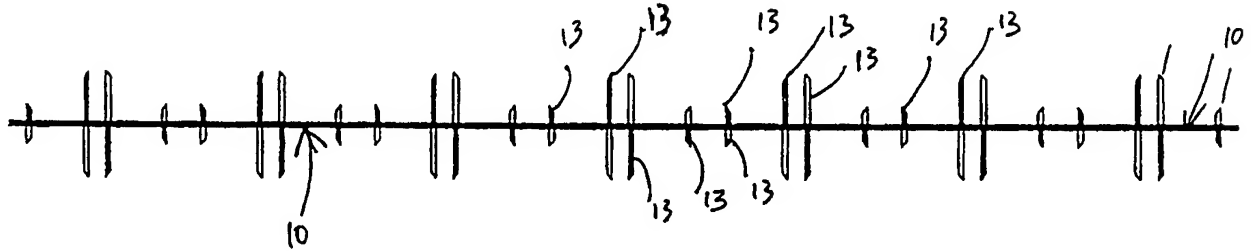


Figure 6C

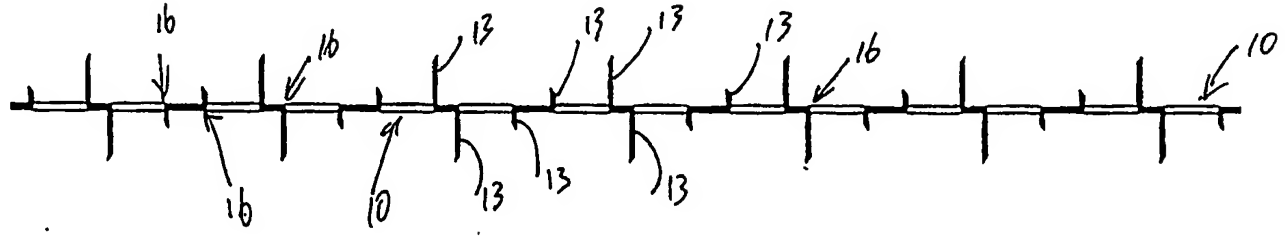


Figure 7A

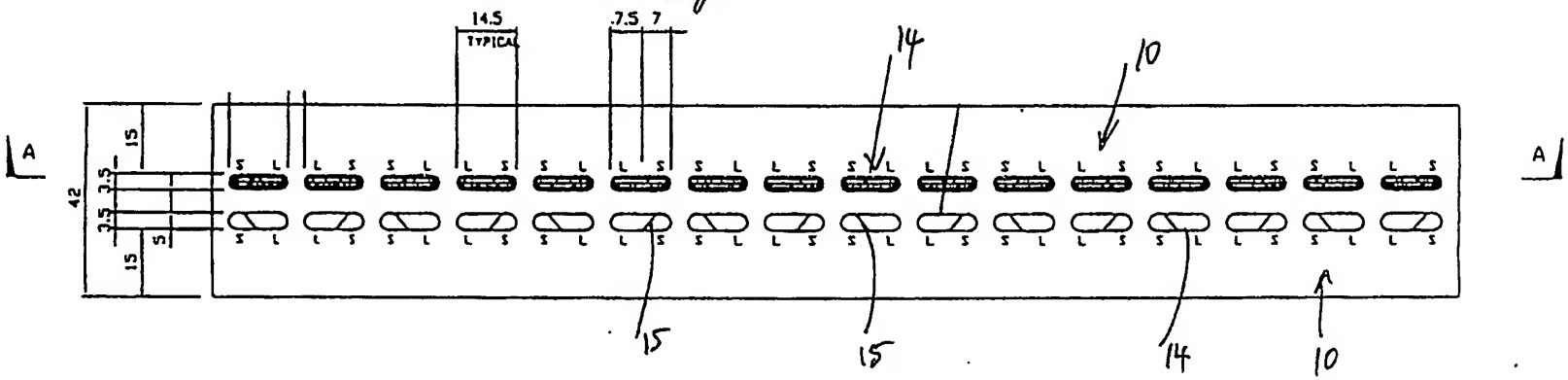


Figure 7B

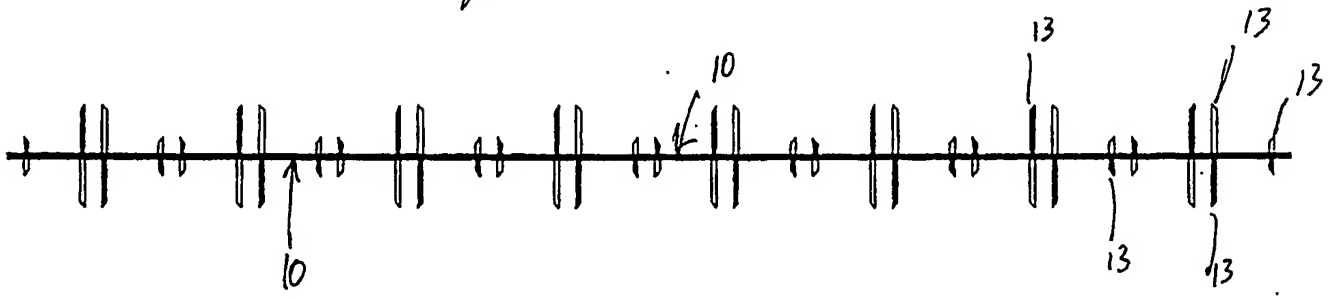


Figure 7C

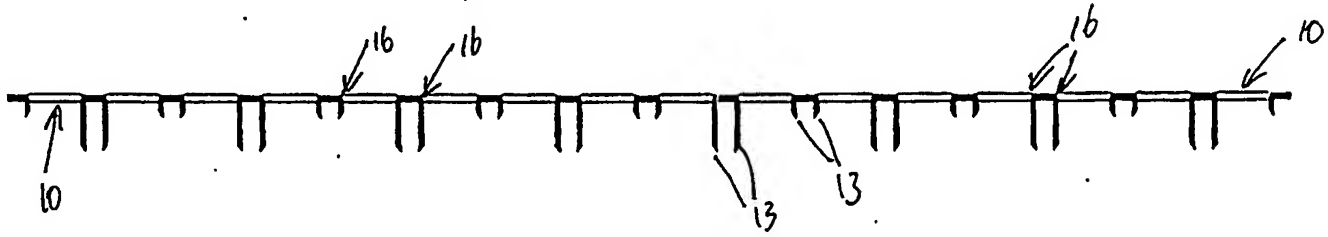


Figure 8A

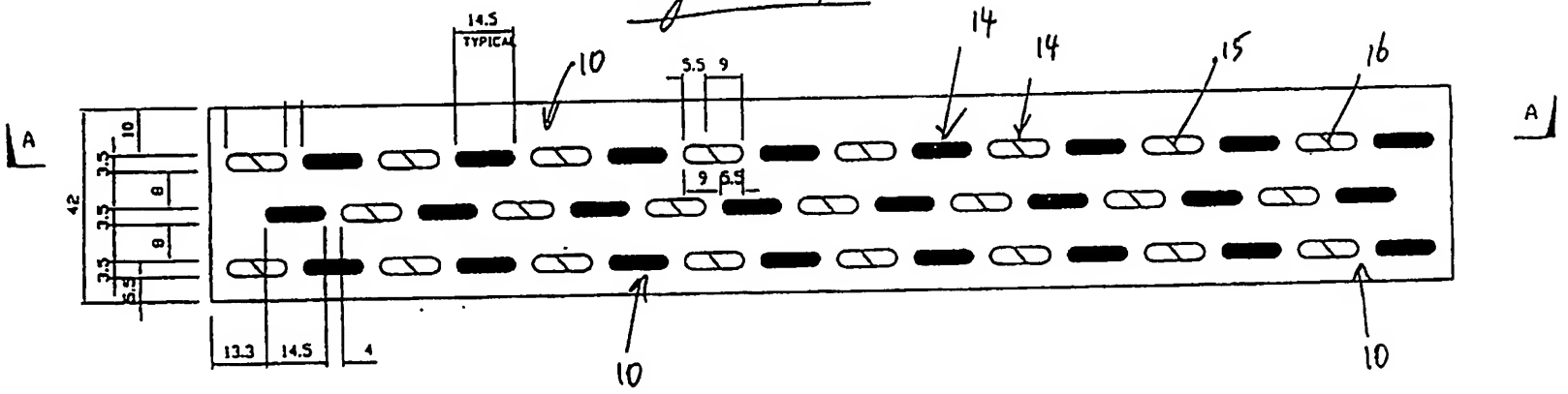


Figure 8B

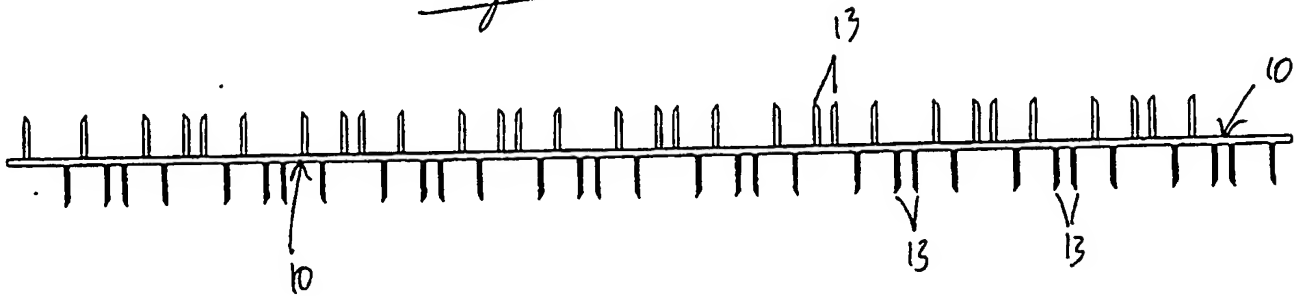


Figure 8C

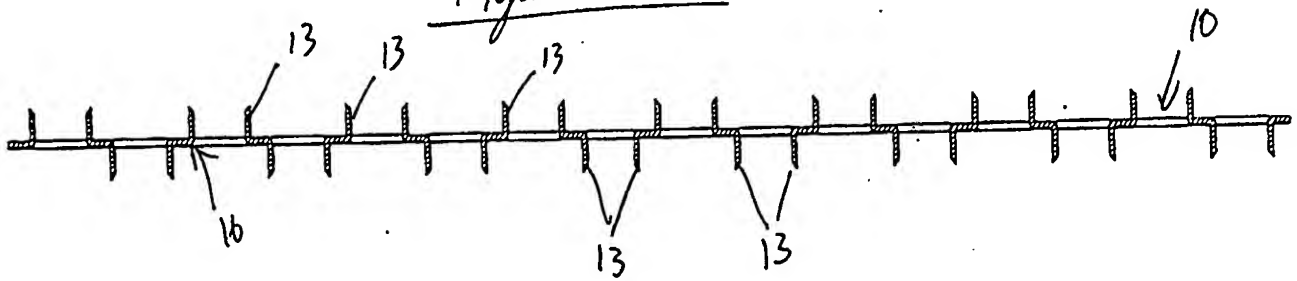


Figure 9A

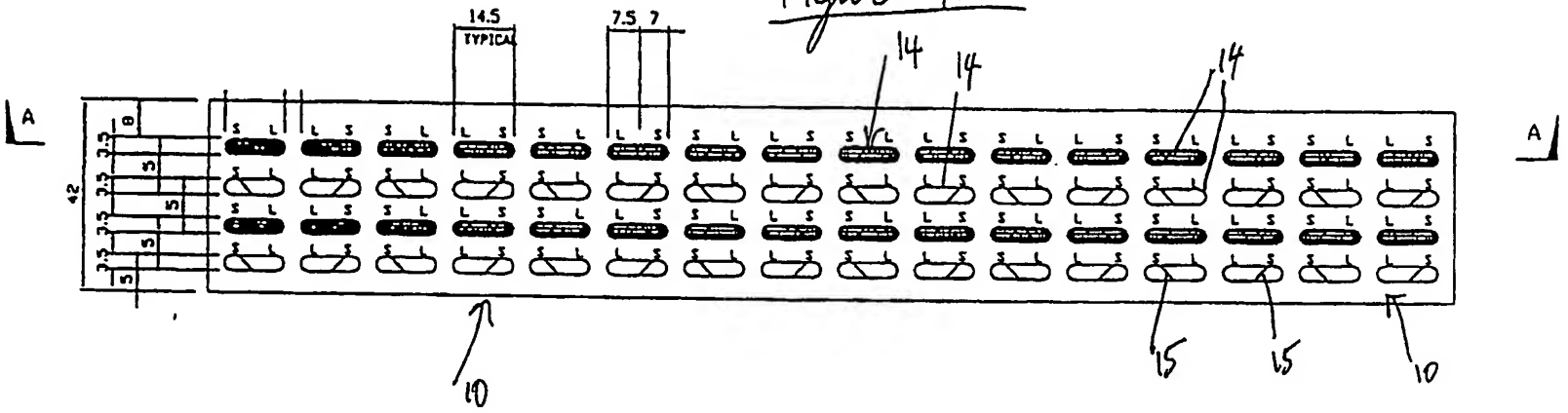


Figure 9B

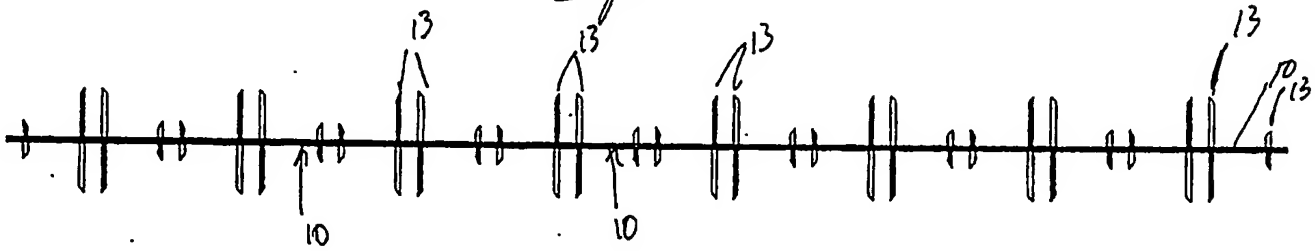


Figure 9C